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Citation: Inam, Fawad (2014) Carbon nanotechnology for future aerospace. In: International Conference on Nanomaterials and Nanotechnology 2014 (ICNN-2014), 7-9 April 2014, Karachi, Pakistan.

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Carbon nanotechnology for future aerospace

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Carbon nanotubes (CNTs) and graphene are being widely investigated for their addition in polymer, ceramic and metal matrices to prepare nanocomposites owing to the combination of the superlative mechanical, thermal, and electronic properties attributed to them. These materials are subject of significant research interest for their utilisation in an increasing number of applications including energy, transportation, defence, automotive, aerospace, sporting goods, and infrastructure sectors. Particularly among brittle materials (polymers and ceramics), carbon nanofillers have been reported to significantly improve mechanical, thermal and electrical properties. Apart from these improvements, such nanofillers also offer structural damage sensing ability to materials specific to aerospace applications. Structural health monitoring (SHM) is a type of a Non-destructive Evaluation (NDE) technique that essentially involves the strategic embedding of conductive filler into a structure to allow continuous and remote monitoring for damage, deformation and failure. SHM technology is applied increasingly for research and industrial purposes as a potential tool for quality assurance. However, many of the developed and available NDE technologies are complex, expensive and require significant calibration with the passage of time. Nanostructured carbon embedded systems have proven to be more sensitive towards structural damage. The current talk focusses on the development of a novel method for assessing structural damage by analysing change in the electrical conductivities of ceramic and polymer nanocomposites filled with different types of carbon nanofillers (including carbon black).